Fabrication and Testing of an Solar Auto Service Station

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***Abstract*— Solar energy is rapidly gaining notoriety as an important means of expanding renewable energy resources. As such, it is vital that those in engineering fields understand the technologies associated with this area. My project will include the design and construction of a solar operated "SOLAR WATER SERVICING UNIT. This solar operated "Solar water servicing unit" is used to clean the light vehicles, especially two wheelers and delivers through a nozzle under high velocity. The air is compressed by a hand operated gate valve. The main components are water tank, nozzle, connecting tubes, one way valves and pneumatic air compressor. The solar panel is used to charge the battery and this charge is used to drive the D.C compressor to store the compressed air to the air tank.**

Solar tracking allows more energy to be produced because the solar array is able to remain aligned to the sun. This system builds upon topics learned in this course. A working system will ultimately be demonstrated to validate the design. Problems and possible improvements will also be presented.

The pneumatic air is supplied to the portable service unit water tank by the compressor unit. The high pressure air is then delivered to the water tank through a hose. The water tank (25 liter) has a working capacity of 12 liter. The water tank is provided with a pressure gauge, safety valve, water inlet, and water outlet and air inlet. The pressure water in the tank is delivered through a nozzle at a high velocity. Solar panel has been used increasingly in recent years to convert solar energy to electrical energy. The solar panel can be used either as a stand-alone system or as a large solar system that is connected to the electricity grids. We are trying to consume more energy from the sun using solar panel. In order to maximize the conversion from solar to electrical energy, the solar panels have to be positioned perpendicular to the sun. Thus the tracking of the sun's location and positioning of the solar panel are important. The goal of this project is to design an automatic tracking system, which can locate the position of the sun.

***Index Terms*—solar array, pneumatic air compressor, stability, Assembling,**

I. INTRODUCTION

This machine can be used for cleaning light vehicles, especially for two wheelers and 3 wheelers and it has a better performance in agricultural purposes. Now days this machine can have a good market because of the following reasons. The solar panel is used to charge the battery and this charge is used to drive the D.C compressor to store the compressed air to the air tank.

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1) It is very simple in construction and using a simple mechanism.
2) Easy to operate
3) Since it is hand operated with no electrical power is required.
4) Available at low cost
5) It saves time and money.
6) It is portable
7) If needed it can also be operated with a compressor

Using a D.C compressor the water is pressurized by compressing the air in the water tank. Then it is delivered through a nozzle under high pressure about 15 kg/cm².

A solar cell (also called a photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic. It is a form of photoelectric cell (in that its electrical characteristics—e.g. current, voltage, or resistance—vary when light is incident upon it) which, when exposed to light, can generate and support an electric current without being attached to any external voltage source, but do require an external load for power consumption.

The term "photovoltaic" comes from the Greek meaning "light", and from "volt", the unit of electro-motive force, the volt, which in turn comes from the last name of the Italian physicist Alessandro Volta, inventor of the battery (electrochemical cell). The term "photo-voltaic" has been in use in English since 1849.

Photovoltaic's is the field of technology and research related to the practical application of photovoltaic cells in producing electricity from light, though it is often used specifically to refer to the generation of electricity from sunlight. Cells can be described as photovoltaic even when the light source is not necessarily sunlight (lamplight, artificial light, etc.). In such cases the cell is sometimes used as a photo detector (for example infrared detectors), detecting light or other electromagnetic radiation near the visible range, or measuring light intensity.

The operation of a photovoltaic (PV) cell requires 3 basic attributes:

1. The absorption of light, generating either electron-hole pairs or excitons.
2. The separation of charge carriers of opposite types.
3. The separate extraction of those carriers to an external circuit.

In contrast, a solar thermal collector supplies heated by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation. "Photo electrolytic cell" (photo electrochemical), on the other hand, refers either to a type of photovoltaic cell (like that developed by A.E. Becquerel and modern dye-sensitized solar cells), or to a device that splits water directly into hydrogen and oxygen

using only solar illumination.

A.Small scale industry

Today one of the most important problems that the country faces is the unemployment of youth. It is an accepted fact that to solve the unemployment problems, small scale industries are established to a great extent. At present the small scale sector contributes nearly 25% of total industrial output and employs nearly 50 lake persons. Small scale industries have large scope in our country. This will, not only solve the unemployment, but will also help to utilize the local resources wherever available.

Small scale industry is an industry, investments of which do not exceed Rs.45 lakes in plant and machinery. Generally, these industries give employment to 10-15 persons. The value of plant and machinery includes the investment made in the production plant and machinery. In calculating the value of plant and machinery, the actual payment made by the owner, irrespective of whether the plant and machinery is old or new will be taken into account. Other expenses such as the cost of tolls, jigs dies, moulds and spare parts for maintenance, installation cost of the plant and machinery etc. Will be taken into account while calculating the value of plant and machinery.

B.Roll of small industries

Small scale industries have a dynamic role in accelerating the rate of industrial growth and attaining economic prosperity of a developing nation like India. The Planning Commission Observed that the small scale industries can play the following important roles in accelerating the rate of industrial growth and economic prosperity.

1. They provide immediate and permanent employment on a large scale at relatively small capital investment.
2. They can meet the needs and increase demand for consumer goods.
3. They offer a good method of ensuring a more equitable distribution of national income.
4. They help for growing in an efficient and progressive decentralized section of the economy.
5. They provide more opportstationies of work and income.

C.The project engineering of small scale plants

A large number of process plants in India still continue to be small scale sector in which a few basic items of equipment are employed to give a variety of product. To a considerable extend the success of an industry depends on the efforts and money put in for its plant.

This especially does in a country like India, where raw materials supply is controlled where availability of electric and motive power are often restricted and where market conditions and supplies to government agencies face uncertainties, restrictions from the variation in public spending and so on.

From a number of postmortems, industries that have failed, show that the major cause for their failure was lack of adequate planning industry resembles very much the elaborate preparation that are done before the success and profits of the industry depends.

D.The project report or the techno-economic feasibility report

A project is a comprehensive blueprint of entrepreneur's proposed venture and his future visualization of his station. It will consist of everything grown, the details of his proposed assessment of the market, availability of raw materials, production plans, availability of personal and laborers etc.

E.Procedural formalities to set up and manage a small scale industries station

A small scale industrial station is defined as one whose investment in plant and machinery does not exceed Rs. 35 Lacks. (Rs.45 lacks in case of ancillary industrial stations). To start such a station no legal formation, such as license, or registration is required except for certain types of industries like food processing and drug manufacturing etc. Though it is not obligatory on the part of the small scale station to get registered with the Director of Industries, it is very advantageous to do so on account of the various benefits available to the registered small scale stations like allotment of scarce raw materials, sales tax, loan, issue of import license on machinery and raw materials etc.

The small scale industries should, however, submit register returns to such authorities like Factory Inspector, Sale tax Inspector, Central Excise authority to meet statutory obligations.

i) Marketability
ii) Profitability
iii) Technical feasibility
iv)Economic viability
v) Stability
vi) Reasonable growth in future.

II. MARKET SURVEY

Market research is the analysis of the project to be started, expanded or modified, broadly speaking market research is the commercial research for the suitability of a business and is a continuous process, as a researcher is always kept continued for the stability of the business, market research is very essential in any production because the volume of production depends on the continuity of demand. If demand reduced suddenly production comes to a standstill, which may result great losses to manufactures.

Market research includes forecasting, intelligence and statistics. Market research may be defined as a way of finding out facts which must be known before a market policy is to be determined.

The market research analysis is a scientific method of determining what to produce, who the purchaser are, where these are located, how much to manufacture, how to sell, when to sell in order to minimize the service rendered and to maximize the profits earned. Market research is subdivided into four general classifications as follows:

1. Product analysis
2. Market analysis
3. Distribution analysis
4. Competition analysis

A.Selection of Pneumatics

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatics is an attractive medium for low cost mechanization particularly for sequential or repetitive operations. Many factories and plants already have a compressed air system, which is capable of

providing both the power or energy requirements and the control system (although equally pneumatic control systems may be economical and can be advantageously applied to other forms of power).

The main advantages of an all-pneumatic system are usually economy and simplicity, the latter reducing maintenance to a low level. It can also have outstanding advantages in terms of safety.

Pneumatic cylinders are widely used to generate force and motion on a vast range of OEM equipment. They can move products directly or indirectly by pushing, pulling, lifting, lowering, or rotating, and can keep them from moving by clamping them in place.

Wide acceptance comes in large part because cylinders are simple, economical, durable, and easy to install. They can produce thousands of pounds of force over a broad range of velocities; cycle at high speeds without overheating; and stall without internal damage. And they readily tolerate tough conditions such as high humidity, dusty environments, and repetitively high-pressure wash downs.

Pneumatic actuators come in literally thousands of styles, sizes, and configurations. This variety makes more innovative-equipment possible, but sorting out the best cylinder for an application can be a bit overwhelming. Here are some key considerations.

B. Cylinder design

The basic, rod-style industrial cylinder consists of a tube sealed with end caps. A rod attached to an internal piston extends through a sealed opening in one of the ends. The cylinder mounts to a machine and the piston rod acts upon the load.

C. Force output

Another key selection criterion is how much force a cylinder generates. Determine this from the air pressure and bore size (the ID of the cylinder.)

A general rule of thumb is that for vertical and high-friction applications, the required force should be twice the load to be moved. In some cases, additional force is necessary to compensate for friction.

Designers can calculate cylinder force by multiplying the effective piston area by the working pressure. The effective area for push force is the cylinder bore. For pull, it's the bore area less the cross-sectional area of the piston rod. Thus, the theoretical push force is:

$F = \pi (D2/4 – d2/4) P$

where F = force, lb; D = cylinder bore, in.; and P = pressure, psi.

Theoretical pull force is:

$F = \pi (D2/4 – d2/4) P$

where d = piston rod diameter, in.

Force calculations get more complicated in single-acting cylinders with a spring. The force opposing the push or pull increases as the stroke progresses. In practice, manufacturers' catalogs often list push and pull values for both double-acting and single-acting cylinders, simplifying calculations for users.

When estimating the relative force of cylinders with different bore sizes, remember that thrust increases with the square of the diameter. In other words, doubling the bore will quadruple the thrust.

D. Speed

Speed affects productivity, longevity, and controllability. Calculate the stroking speed of a pneumatic cylinder from:

$s = 28.8q/A$

Where s = speed, ips; q = airflow in standard cubic feet/minute; and A = piston area, in.2

Other factors that might affect speed include port sizes, inlet and exhaust flow through control valves, and hose or tubing sizes — if they create bottlenecks that restrict air flow to or from the cylinder. Likewise, air pressure that is barely capable of moving the load will hamper speed.

For most applications, unidirectional flow regulators installed to restrict flow out of the cylinder and permit free flow in give the best results. A regulator in the rod-end port controls extension speed, and one on the cap-end port controls retraction.

E.Additional considerations

After sizing a cylinder for force and stroke, engineers have a lot of leeway in tweaking a cylinder so it best fits an application. Here are a few considerations.

- Port sizes and locations
- Envelope dimensions.
- Mounting
- Cylinder materials.
- Seal materials.
- Position feedback.
- Cushions.

III. PRODUCTION OF COMPRESSED AIR

A. Pneumatics

The word 'pneuma' comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation.

Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply.

The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure.

Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

The compressibility of the air was first investigated by Robert Boyle in 1962 and that found that the product of pressure and volume of a particular quantity of gas.

The usual written as

$PV = C$ (or) $P_1V_1 = P2V2$

In this equation the pressure is the absolute pressured which for free is about 14.7 Psi and is of courage capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer. Any gas can be used in pneumatic system but air is the mostly used system now a days.

B.Production of compressed air

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Clean condition of the suction air is one of the factors, which decides the life of a compressor. Warm and moist suction air will result in increased precipitation of condense from the compressed air. Compressor may be classified in two general types.

1. Positive displacement compressor.
2. Turbo compressor

Positive displacement compressors are most frequently employed for compressed air plant and have proved highly successful and supply air for pneumatic control application.

The types of positive compressor

- Reciprocating type compressor
- Rotary type compressor

Turbo compressors are employed where large capacity of air required at low discharge pressures. They cannot attain pressure necessary for pneumatic control application unless built in multistage designs and are seldom encountered in pneumatic service.

C.Reciprocating compressor

Built for either stationary (or) mini service the reciprocating compressor is by far the most common type. Reciprocating compressors lap be had is sizes from the smallest capacities to deliver more than 500 m³/min. In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15 bars.

Discharge pressure in the range of 250 bars can be obtained with high pressure reciprocating compressors that of three & four stages. Single stage and 1200 stage models are particularly suitable for pneumatic applications , with preference going to the two stage design as soon as the discharge pressure exceeds 6 bar , because it in capable of matching the performance of single stage machine at lower costs per driving powers in the range .

Compressed air is used for many purposes, including:

- Pneumatics, the use of pressurized gases to do work
- Pneumatic post, using capsules to move paper and small goods through tubes.
- Air tools
- HVAC control systems
- Vehicle propulsion (see compressed air vehicle)
- Energy storage (see compressed air energy storage)
- Air brakes, including:
- railway braking systems
- road vehicle braking systems
- Scuba diving, for breathing and to inflate buoyancy devices
- Refrigeration using a vortex tube
- Air-start systems in engines
- Ammunition propulsion in:
- Air guns
- Airsoft equipment
- Paintball equipment

D. Compressed air riser piping from air compressor(s)

The riser piping should connect to the top of the header piping and be one pipe size larger than the compressor discharge piping and/or overhead header piping. A drip leg with a drain is needed to prevent water from flowing back to the compressor. Mount valves in the highest horizontal piping (this avoids the hazard of opening a closed valve in vertical piping, and releasing trapped condensate to flow back into air compressors). All of the header main compressed air piping should slope 1/8" to 1/4" per foot down and away from the point of origin. Gravity and airflow will then carry condensate to the low points where a drop leg should be installed to allow for removal at accessible drop legs and drain points. These drops should be installed every 50 to 70 feet in the system and be taken from the bottom of the main line to insure as much removal as possible.

E.Compressed Air Rooms with Multiple Air compressors

Where multiple air compressors are to connect the riser piping to the top of overhead piping headers. The inlet piping for Air Dryer(s) should connect to the bottom of the piping headers.

F.Compressed Air Distribution Piping outside of Air compressors rooms

All of the header main compressed air piping should slope 1/8" per foot down from the point of origin. Gravity and airflow will then carry condensate to the low points where drop leg should be installed to allow for removal at to accessible drop legs and drain points. For larger plant, as the piping elevation lowers, a full size tee with a bottom drip leg preceding an elbow turned up to raise the pipe elevation. These drip legs & up turned elbows are typically 200 to 300 feet apart, i.e. the main piping slopes about 1/100 feet, and the elbow up raises the piping elevation 2 to 3 feet. Compressed air should flow through the straight ends of a tee and should never hit the back side of a tee.

IV. SITE SELECTION

When it has been decided to start an industry, it is most important to select a suitable site or location to house the industry. The location has great effect on the success or the failure of the operation of an industry. Therefore it should be based up on a careful consideration of all the factors that are essentially needed in efficient running of a particular industry. The necessary factors of in the selection of plant location vary among industries and with changing technical and economical considerations. Site selection is not an easy problem because

if the selection is not proper, then all money spent on industry, building, machinery and the installation will go as waste.

The various factors taken into consideration while selecting this site as follows:

1. This is an urban area. Therefore the cost of land is less than in the city area and easier to provide space for future expansion.
2. Rail and road connection can be obtained easily.
3. Lesser taxes restriction
4. The possibility to get skilled labour is prevalent in this area.
5. Raw material for the industry is available at Mangalore at cheap rate.
6. For banking facilities two banks of S.B.T. and S.B.I. are situated near the firm

A.Components Description

The fabrication of solar service station consists of the following components/parts.

B.Base

It is made of angle iron with wheels provided on which the whole machine is fitted. Figure1 shows the schematic diagram of the base.

Figure 1: Supporting elements

These are made of mild steel flat which are used to support the water tank.

C.Compressors

The main function of the air compressor is to compress the air up to the required pressure. The maximum capacity of the compressor is $10x10^5$ to $12\ x10^5$ N/m^2. This is a two stages or two-cylinder reciprocating air compressor. The two cylinders are for low and high compression. The air pressure is measured at various places by the use of pressure gauges. V-belt and pulley are used to drive the compressor.

D.Selection criteria for compressors

A number of factors are involved in the selection criteria of a suitable air compressor. These are dealt here briefly

- Pressure

First of all, the pressure needed must be determined. Most air operated system and tools are designed to operate at a pressure from $6\ x10^5$ to $7\ x10^5$ N/m^2. A compressor of normal make and type would normally be suitable if this can assure a pressure $6\ x10^5$ N/m^2 in the distribution line laid down for a pneumatic tools and system.

- Capacity

Another important factor in compressor selection is the capacity or volume of air required. This factor is sometimes extremely difficult to evaluate.

- Compressor

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E.Pressure gauge

Pressure gauge is used for measuring the outlet pressure of air from the compressor. The gauge used is Bourdon type pressure gauge. The maximum capacity of this gauge is $10\ x10^5$ to $12\ x10^5$ N/m^2. The gauge is fitted at the outlet of the air compressor.

F.Tank

It is made of mild steel sheet (16 gauges) having storing capacity of 20 liters and which can withstand 15kg/cm².

G.Taps

Two taps are fitted on the water tank. One is used for draining purposes and the other is controlling the water level.

H.Nozzles

It is a narrow passage which increases the velocity of water passing through it.

I. Nuts and bolts

It is used to join the parts temporary.

J.Connectors

In our system there are two types of connectors used; one is the hose connector and the other is the reducer. Hose connectors normally comprise an adapter (connector) hose nipple and cap nut. These types of connectors are made up of brass or Aluminium or hardened steel.

The inlet and outlet pressure level is varying, from a deep vacuum to a high positive

Pressure, depends on process' necessity. This inlet and outlet pressure is related, corresponding with the type of compressor and its configuration. as shown in Figure 2.

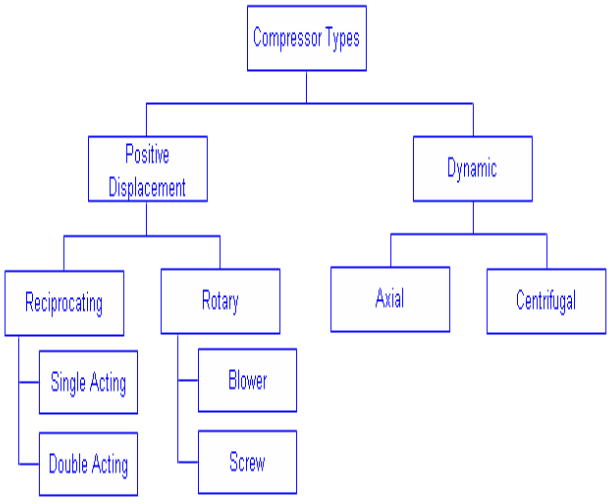

Figure 2: Types of compressor

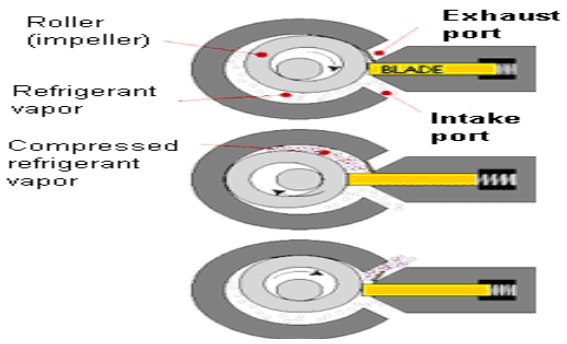

Figure 3: Rotary compressor

Figure 3 shows the schematic diagram of the Rotary compressor. Rotary compressor is a group of positive displacement machines that has a central, spinning rotor and a number of vanes. This device derives its pressurizing ability from a spinning component. The units are compact, relatively inexpensive, and require a minimum of operating attention and maintenance.

Design Consideration

Design consideration includes the following

a. Gas Composition-
b. Corrosiveness-
c. Fouling tendency-
d. Liquid in gas stream-
e. Inlet pressure –
f. Discharge pressure –
g. Inlet temperature-
h. Discharge temperature-

V. FABRICATION

In the solar service station the following parts were fabricated.

A.Base

The base is made by angle iron of size (800 x 500 x 40) mm by cutting and welding. For mounting tank, Cylinder and handle lever support six holes are drilled on it. The angle iron of base is shown in figure 4.

Figure 4: The schematic view of angle of iron

B.Supported elements

M.S. Flat pieces are made in required dimension by cutting, filling and grinding. The pieces are welded, drilled for supporting the handle lever, cylinder and tank.

C.Handle

Handle lever is made by drilling and grinding on a G.I. Pipe of the required size. Figure 5 shows the schematic view of handle lever (G.I.Pipe).

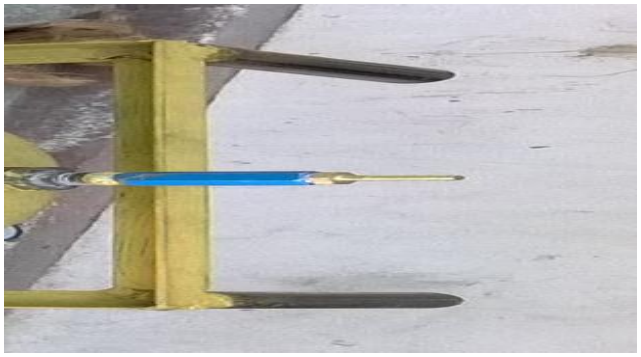

Figure 5:The schematic view of handle lever (G.I.Pipe).

D.One way valve

It is made by turning, facing, thread cutting and boring on a M.S. Rod.

E.Tank

A cylindrical tank is made by cutting, grinding, drilling, welding and bolting on a 16 gauge M.S. Sheet. Safety valve, pressure gauge, water inlet valve, water outlet valve, air inlet valve are fitted on it. Figure 6 shows the schematic view of tank.

Figure 6: The schematic view of tank (M.S.SHEET)

F.Compressor

Compressor is a device used to increase the pressure of compressible fluid, either gas or vapour, by reducing the fluid specific volume during passage of the fluid through compressor. One of basic aim of compressor usage is to compress the fluid, then deliver it to a higher pressure than its original pressure. The inlet and outlet pressure level is varying, from a deep vacuum to a high positive

Pressure, depends on process' necessity. Figure 7 shows the schematic view of Compressor.

Figure 7: The schematic view of COMPRESSOR

G.Pressure gauge

Pressure gauge is used for measuring the outlet pressure of air

from the compressor. The gauge used is Bourdon type pressure gauge. The maximum capacity of this gauge is 10 $x10^5$ to 12 $x10^5$ N/m^2. The gauge is fitted at the outlet of the air compressor. Figure 8 shows the schematic view of Pressure gauge.

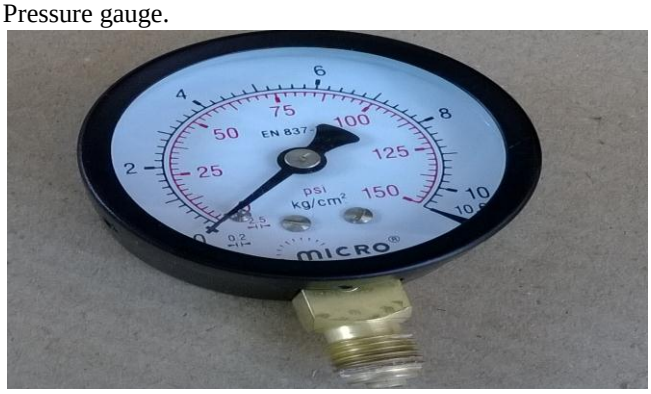

Figure 8: The schematic view of Pressure gauge

H.Solar panel

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells don't need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting. PV cells are made from layers of semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced. Groups of cells are mounted together in panels or modules that can be mounted on your roof. The power of a PV cell is measured in kilowatts peak (kWp). That's the rate at which it generates energy at peak performance in full direct sunlight during the summer. PV cells come in a variety of shapes and sizes. Most PV systems are made up of panels that fit on top of an existing roof, but you can also fit solar tiles. Figure 9 shows the schematic view of Solar panel.

Figure 9: The schematic view of Solar panel

I.Battery

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work.

Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable devices. Secondary (rechargeable batteries) can be discharged and recharged multiple times; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium ion batteries used for portable electronics. Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to battery banks the size of rooms that provide standby power for telephone exchanges and computer data centers. Figure 10shows the schematic view of battery.

Figure 10: The schematic view of Battery.

J. Assembling

After inspection is over all the individual parts are taken to the assembling section where these parts are assembled together.

The following steps are followed for the assembling produce.

1. Base and supporting elements are welded together.
2. Fitted the water tank cylinder on the supporting stand.
3. Connected one end of the handle lever to the supporting element fitted the connecting rod to the handle lever.
4. Connect the pressure gauge, water inlet valve, water outlet valve, air inlet valve which is bolted to the tank.
5. Placed the tank on the supporting stand.
6. Provide the hose connections for
   1) Air inlet
   2) Water outlet with nozzle
7. Clamping arrangements are fixed properly.
8. Lubricate all the moving parts, check and verify its working condition.
9. The assembled station is taken to the store.

VI. WORKING PRINCIPLE

This solar operated "SOLAR WATER SERVICING UNIT" is used to clean the light vehicles especially two wheelers and delivers through a nozzle under high velocity. The air is compressed by a hand operated gate valve. The main components are water tank, nozzle, connecting tubes, one way valves and pneumatic air compressor. The solar panel is used to charge the battery and this charge is used to drive the D.C compressor to store the compressed air to the air tank. The pneumatic air is supplied to the portable service unit water tank by the compressor unit. The high pressure air is then delivered to the water tank through a hose. The water tank (25 liter) has a working capacity of 12 liter. The water tank is provided with a pressure gauge, safety valve, water inlet, and water outlet and air inlet. The pressure water in the tank is delivered through a nozzle at a high velocity. Figure 11shows the frame of the portable service unit.

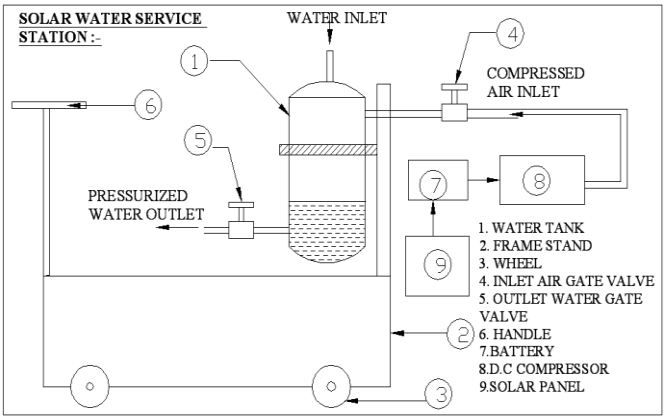

Figure 11: The Solar water service stations

Figure 12: The Solar water service stations

This solar operated "Solar water service station unit" is used to clean the light vehicles especially two wheelers and delivers through a nozzle under high velocity. The air is compressed by a hand operated gate valve. The main components of the solar water service station are

- Water tank
- Nozzle
- Connecting tubes
- One way valves
- Pneumatic air compressor
- solar panel

The solar panel is used to charge the battery and this charge is used to drive the D.C compressor to store the compressed air to the air tank. The pneumatic air is supplied to the portable service unit water tank by the compressor unit. The high pressure air is then delivered to the water tank through a hose. The water tank (25 liter) has a working capacity of 12 liter. The water tank is provided with a pressure gauge, safety valve, water inlet, and water outlet and air inlet. The pressure water in the tank is delivered through a nozzle at a high velocity. Figure 12 shows the solar water service stations.

VII. CONCLUSION

The matter discussed in the earlier page just give a board outline for starting managing an industry in small scale sector. We have tried our level best to give ear picture about the needs and requirements of industry which produces "Mini Servicing Station" in the earlier pages. Every attempt has been made to reduce cost and material movement.

The main consideration in the layout and running is practical rather than the accuracy of facts and figures. Considering above factors so far discussed, it can be clearly seen that this is a feasible project. It can be also found that it posses' economic viability and profitability projection.

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